

ICESat CCB Minutes – December 16, 1999

An ICESat Configuration Control Board (CCB) meeting was held on December 16, 1999 to review and evaluate ICESat-CCR-004 (Extension of the GLAS Telescope Sunshade). The proposed change is to extend the sunshade by 32 cm (12.6 inches) from its current length.

The extension is requested because the GLAS secondary mirror structure in the current baseline receives direct sun illumination during the mission. As a result, the structure needs to be blanketed with highly reflective silver Teflon to minimize thermal loads. The blanket minimizes the misalignment affects due to thermal gradients, which can cause an out of focus condition or a shift in the bore sight. However, stray light analysis shows unacceptable optical S/N degradation due to reflectance off the silver Teflon blankets into the GLAS detectors. The proposed extension eliminates solar illumination on the secondary reflector and the structure, which means the structure will operate "in the shade" with reduced thermal distortion and significantly less stray light reflectance.

The proposed sunshade extension would interfere with the two spacecraft –X outboard solar array panels in their stowed positions; two implementations are proposed to address this interference. The GLAS telescope sunshade could include two "channels" running down part of the sunshade to eliminate interference with the current stowed position of the two solar array panels. In the second approach, BASD could accommodate the sun shade extension by rotating the two interfering solar array panels a few degrees outward, clearing the extended (unchanneled) sunshade.

Extensive discussion took place over the channeled sun shade implementation. Analysis by the GLAS team shows that the closest sunshade-to-array-panel clearance is 3.6 cm (1.4 inches) inside the channel; BASD concurs this is sufficient. However, the Instrumenter expressed a very real concern about possibly needing to redesign the Laser Transfer Reflector (LTR) to assure accommodating the channel. The Bench Checkout Equipment (BCE) could also require significant changes, but these changes were not available for review at the CCB. The channel would be difficult to manufacture into the cylinder sunshade shape, requiring stiffening ribs and tailoring of the rim to assure that the telescope dust cover seals. The following sections address the system impacts of the channeled sunshade extension.

While the longer sunshade length provides better light rejection, the change also has an extremely slight (favorable) lowering of the required spacecraft tip-off rate. The outboard edge of the proposed sun shade is within 11.7 cm (4.6 inches) of the fairing static envelope, which is well within allowable margin. The structural frequency of the sunshade changes very slightly with the additional mass of 1 kg, although detailed modeling and analysis is required to assure the resonant frequency remains above 50 Hz. The proposed change would reduce the telescope receiver link margin by 0.1 dB which was judged acceptable by the Instrument Scientist.

The effects on the spacecraft of the sunshade extension (channeled or not) would be an invasion of the fields-of-view of two nadir sensors. To accommodate this, BASD proposed raising the mast heights of the nadir antenna and laser reflector, updating the on-orbit power analysis to quantify solar array shadowing, updating the Observatory thermal model for the new configuration, reviewing the propulsion budget analysis, and updating the ACS analysis. The BASD T/V chamber is big enough to accommodate the extended sunshade, including existing fixtures.

The Instrumenter estimates the cost to GLAS for the change is approximately \$65K and an additional 1 kg mass. There would be several weeks delay in the delivery of the telescope sunshade, but no schedule affect on the GLAS instrument delivery.

The BASD estimate is \$78K to extend the masts, with no schedule impact. The additional mass for the extended masts is 1 kg.

For the extended sunshade implementation with no channels, the effects on GLAS are the same as above, except there is no degradation in the telescope receiver link margin and no effects on the LTR and BCE.

BASD proposed changing the solar array panel stowage angle from 51° to about 45° by using a spacer to extend the eight existing solar array tie down brackets (for symmetry and simplicity, BASD recommends changing the stowage angles for both the +X and -X panels). BASD would perform the same analyses detailed above. BASD stated that the total mast plus solar panel change would cost \$158K with an additional 2 kg mass impact (3 kg total). BASD viewed the effort as a low risk approach with no schedule impact.

The CCR was approved to authorize GLAS to extend the sun shade no more than 32 cm without channels, and for BASD to change the stowed position of the array panels and extend the sensor masts. The total cost impact is \$223K with 4kg total mass increase.